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# Domestic Purchase Requirements for Import License Allocations in Mali

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To obtain import licenses for sugar and tea, prospective importers in Mali were required to purchase a certain amount of domestic output. The efficiency of this kind of arrangement relative to that of a direct trade restriction such as a tariff depends on the policy's objective and whether the protected industry is competitive or a monopoly.

This paper — a product of the Trade Policy Division, Country Economics Department — was prepared as background material for the joint UNDP/World Bank Trade Expansion Program, which provides technical and policy advice to countries wishing to reform their trade regimes. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Sheila Fallon, room N10-035, extension 37947 (25 pages, including figures).

The government of Mali, as part of its trade liberalization program, substituted an import licensing system for the state trading agency that had held import monopolies on a number of products. To get licenses to import sugar and tea, prospective importers were required to purchase given amounts of domestic output. The volume of imports was thus “linked” to domestic output of the imported products.

Takacs investigates the economic impact of these linking arrangements under two domestic market structures: perfect competition and monopoly. The arrangements have an effect equivalent to that of a tariff when the tariff revenue is transferred to the domestic industry as a subsidy. The cost of these linking arrangements to the country imposing them may be greater or smaller than the cost of tariffs, depending on the policy’s objective and the structure of the protected industry.

If the protected industry is competitive, linking arrangements are less costly than tariffs if the objective is to increase domestic production or maintain a given degree of self-sufficiency (defined as maintaining a particular ratio of imports to domestic production). The reverse may be true if the protected market is a monopoly.

Price controls on the products subject to linking arrangements dilute the effectiveness of the arrangements and cause disequilibrium in the market between distributors and consumers. Removing price controls before the linking arrangements in a liberalization program would drive up prices for both consumers and producers, provide false signals, and possibly increase the costs of adjusting to liberalization.

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## I. INTRODUCTION

As part of its policy of trade liberalization, the government of Mali decided to dismantle the state trading organization, SOMIEX, which had held a monopoly on the importation of milk, sugar, salt, canned tomatoes, tea, tobacco products, and fertilizers.<sup>1</sup>

New procedures were adopted for the importation of these products.<sup>2</sup> These procedures involve a two-stage process in which a prospective importer first must apply for an import authorization (autorisation d'importation), then, after negotiating with foreign suppliers, freight and insurance companies, and arranging for credit, may apply for a final import license (titre définitif d'importation).

For two products, sugar and tea, importers are required to purchase a certain amount of domestically produced output before a final import license will be issued. Importers must purchase one ton of sugar within the country before they will be granted a license to import one ton of sugar. For tea the required ratio of domestic product purchased to import license granted is 0.75. Similar linking arrangements have been used by Niger and Malaysia for rice<sup>3</sup>, Iran for onion and Colombia for hops. Such a system can also work informally. For example reports indicate that in Brazil deals are sometimes struck between a prospective importer and domestic producers in which domestic producers agree to withdraw their opposition to granting an import license if the prospective importer agrees to buy a specified amount from them.

This note investigates the incentive system facing importers under a linking arrangement and their likely behavior. Section II analyzes the impact on imports, consumption and domestic production and the social costs under the assumption that all of the relevant "industries" (production of the product in

the domestic market, importing and distribution) are competitive, in the sense that there are a large number of firms involved and nothing deters new firms from entering the market. Section III focuses on the interaction of the linking arrangement with price controls, because the products in question also have been subject to this additional regulation. The overlapping regulations pose problems of timing in the liberalization process. Should price controls be phased out before, after, or at the same time as the linking arrangement?

Analysis of the competitive market structure is useful to clarify the operation of the linking arrangement and set a baseline for comparison with noncompetitive market structures, but it may not be the relevant market structure in Mali. The complexity of the licensing system and the possibility of arbitrary decisions on import authorizations and licenses may deter entry into the "industry" importing and distributing the product. Moreover, for sugar, there is only one domestic refiner of sugar, which would effectively constitute a monopoly in refined sugar production. Section IV investigates the operation of the linking arrangements when domestic production is monopolized. The conclusion is that the ranking of the policy instruments as a means of obtaining certain objectives may switch if the domestic industry is not competitive.

## II. LINKING ARRANGEMENTS WITH COMPETITIVE INDUSTRIES

### A. A Model of the Linking Arrangement<sup>4</sup>

Assume that there are firms that act as distributors of a product within the domestic market. All output and imports are marketed through these firms, who both buy from the domestic industry and import. Assume that the country is small so that the world market price of the imported product ( $P_w$ ) can be taken as given, that the imported product and the domestic good are identical, and

that both production and distribution are competitive industries. Suppose that importers must buy one unit of domestically produced output to receive a license to import "r" units. Thus  $r = M/Q_d$ , where M is the quantity imported and  $Q_d$  is the amount produced domestically.

Assume that quantity demanded is a decreasing function of the price to consumers ( $P_d$ ) and that the quantity supplied by the domestic industry is an increasing function of price to suppliers ( $P_s$ ). These demand and supply functions can be expressed in inverse forms as:

$$(1) \quad P_d = D(Q_d)$$

$$(2) \quad P_s = S(Q_s)$$

Market equilibrium requires that domestic supply plus imports equal demand:

$$(3) \quad Q_s + M = Q_d$$

Given the linking arrangement,  $M = rQ_s$ , so:

$$(4) \quad (1+r) Q_s = Q_d$$

The distributors are assumed to maximize profits from the distribution of imported and domestic goods. Let lower case m and  $q_s$  denote one distributor's imports and domestic purchases, respectively. Profits equal the difference between the buying and selling prices, less distribution costs, which are assumed to be zero. Profits ( $\Pi$ ) will be given by:

$$\Pi = (P_d - P_w) m + (P_d - P_s) q_s$$

Since for each distributor  $m = r q_s$ ,

$$\Pi = (P_d - P_w) r q_s + (P_d - P_s) q_s$$

Maximizing profit with respect to  $q_s$  would imply:

$$(P_d - P_w) r + (P_d - P_s) = 0$$

or, rearranging,

$$(5) \quad P_d = (1/(1+r)) P_s + (r/(1+r)) P_w$$

Under the linking arrangement, distributors would be maximizing profits when the price to consumers is a weighted average of world and domestic producer prices. Equilibrium prices and quantities under the linking arrangement would be determined by the market equilibrium condition (4) and the equilibrium condition for distributors (5).

Figure 1 depicts the equilibrium when  $r=1$  (as for sugar in Mali).  $S'$  shows the total amount available in the domestic market. It is equal to domestic industry supply ( $S$ ), plus imports allowed under the linking arrangement. Given that  $r=1$ ,  $S'$  horizontally doubles  $S$ .  $D$  is the domestic consumer demand curve.

Given (5) and  $r=1$ , equilibrium will occur at  $C_L$ , where the price at which consumers would buy that quantity lies halfway between  $S'$  and  $P_w$ . The price to consumers would be  $P_d$ ; the price paid domestic producers would be  $P_s$ . At that price, the domestic industry would supply an amount  $Q_L$ . Distributors would be willing to buy an amount  $Q_L$  ( $-ab$ ) from domestic suppliers at a price  $P_s$ , import an amount  $C_L - Q_L$  ( $-bd$ ) at the price  $P_w$ , and sell the entire amount  $C_L$  ( $-ad$ ) at a price of  $P_d$ . An increase (decrease) in " $r$ ", the ratio of imports to domestic production, would rotate  $S'$  farther to the right (left), make the linking arrangement less (more) restrictive, and provide less (more) encouragement to domestic production.

At first it may seem counterintuitive that distributors would buy from domestic producers at a higher price than they charge when they resell to domestic consumers, but they are willing to incur a loss on domestic purchases because those purchases allow them to qualify for import licenses and obtain the profits from selling imported goods. At the margin, the loss on an additional unit of domestic purchases ( $P_s - P_d$ ) exactly cancels the gain on an additional unit

of imports ( $P_d - P_w$ ). Also in total, the profits from importing and selling at the higher domestic price (area  $ginl$ ) are offset by the losses from selling at a price lower than that paid to domestic suppliers (area  $abge$ ).

#### B. Cost of the Linking Arrangement

The linking arrangement causes distortions and imposes net costs upon society of a similar nature but a different magnitude, as those from a tariff or other type of quantitative restriction. Referring again to Figure 1, if no purchase of domestic output were required to import, and there were no other trade restrictions or transportation costs, price would be  $P_w$ , and consumers would purchase  $C_r$ . The increase in price to  $P_d$  causes consumers to cut back their purchases to  $C_l$  and results in a loss to consumers equal to area  $eirj$ .

Under free trade, producers would produce  $Q_r$ . The linking arrangement increases producer price to  $P_s$ , increases output to  $Q_L$ , and results in a gain to producers equal to area  $abkj$  and a production efficiency loss equal to area  $blk$ . Area  $abge$  represents the loss to distributors who buy at  $P_s$  and resell at  $P_d$ . Given that it is equal to the rents obtained by importing under license (area  $ginl$ ), which in turn is part of the consumer loss, distributors can be thought of as intermediaries who transfer area  $abfe$  of the consumer loss to domestic producers. The other part of the producer gain, area  $efkj$ , goes directly from consumers to producers.

Similarly, the production efficiency loss (area  $blk$ ) is a combination of direct loss to consumers (area  $fglk$ ) and indirect loss to consumers, through distributors as intermediaries (area  $bgf$ ). The linking arrangement has the same effect as a tariff rate  $(P_d - P_w)/P_w$  where the tariff revenue ( $-ginl$ ) is used to subsidize the domestic industry.

In this partial equilibrium framework the net cost of the regulation is the



sum of the production deadweight loss (area blk) and the consumption deadweight loss (area irn). Rough estimates of the magnitude of the costs of the linking arrangements for sugar in Mali indicate that in 1988 the annual cost of the linking arrangement was about 1,678 Fcfa per year, or about 5.75 million dollars. Appendix A explains the calculations underlying this estimate.

### C. Policy Objectives and Alternative Policy Instruments

Bhagwati and Srinivasan (1969) have shown that the optimal policy instrument depends crucially on the policy objective. A linking arrangement could be used, at a net social cost, to achieve a variety of policy objectives: (1) increase domestic production above what it would be under free trade; (2) reduce consumption; (3) reduce imports; and (4) maintain a particular ratio of imports to domestic production. The relevant question is whether each goal could be achieved at a lower cost by using another policy instrument. This section compares the linking arrangement with alternative policy instruments such as tariffs, direct subsidies, and consumption taxes, to achieve alternative goals, such as maintaining a particular level of domestic production or consumption, or limiting imports to a particular level or ratio of imports to domestic production.

The linking arrangement depicted in Figure 1 increased production from  $Q_r$  to  $Q_L$  at a cost of area blk plus area irn. A tariff rate of  $(P_s - P_r)/P_r$  would have the same effect on production, but would raise the price charged consumers to  $P_s$ , which would cut back consumption to  $C_r$  and create a consumption deadweight loss equal to area crm, clearly larger than the deadweight loss with the linking arrangement. The linking arrangement increases domestic production at a lower cost than a tariff, but a direct subsidy to the industry would achieve the same

production objective at yet lower cost. A subsidy of  $P_d - P_w$  per unit of output would shift the industry supply curve downward to pass through point 1, and the industry would supply  $Q_L$  at price  $P_w$ . The direct subsidy would avoid consumption losses but the revenue to finance the subsidy would have to be raised in some way, which may be difficult for a country with a fledgling fiscal system, or might impose distortions in other markets. If the goal is to encourage domestic production, and if a direct subsidy is practically or politically infeasible, the linking arrangement will achieve the goal at a lower cost than a tariff.

If the objective is to reduce consumption to  $C_L$ , a tariff rate of  $(P_d - P_w)/P_w$  would do so at a cost in efficiency losses of  $fsk$  plus  $irn$ . This is a lower cost than that incurred under the linking arrangement because the tariff does not provide as large an incentive to increase higher-cost domestic production. A consumption tax at the same rate alone would be the least costly policy, given that it would reduce consumption to  $C_L$  while producers still face the world market price  $P_w$  and thus maintain production at  $Q_p$ .

Countries may want to control imports for balance of payments purposes or to maintain self-sufficiency. This objective could be specified as a given level of imports or as a given ratio of imports to domestic production. If the goal is to maintain a given import level a tariff will do so at a lower cost than a linking arrangement. Figure 2 sets the two policy instruments to result in the same import level ( $bd=st$ ). A tariff rate of  $(P_d - P_w)/P_w$  would result in a consumption deadweight loss equal to area  $tru$ , and a production deadweight loss equal to area  $svk$ . Compared to the linking arrangement, the consumption deadweight loss with the tariff is larger by the area  $tinu$ , but the production deadweight loss is smaller by area  $sblv$ . Since  $vl=un$ , and  $sv=tu$ , the cost of reducing imports to a particular level must be less with the tariff than with

the linking arrangement. In addition, the tariff provides revenue to the government while the linking arrangement transfers revenue to the domestic industry, which may be in private hands.

If the goal is to maintain a given ratio of domestic production to imports, then the linking arrangement is the less costly policy instrument. Figure 3 compares the linking arrangement (again with  $r=1$ ) and the tariff rate  $(P_t - P_w)/P_w$  that would result in the same ratio of domestic production to imports. Compared to the linking arrangement, the tariff leads to a smaller production deadweight loss (area  $cgf < \text{area } ahf$ ), but a larger consumption deadweight loss (area  $dli > \text{area } ekj$ ). The extra cost of the tariff is equal to area  $deji$  less area  $ahgc$ , and area  $deji$  must be greater than area  $ahgc$ .<sup>5</sup> This result implies that a tariff is a more costly method of achieving a given ratio of domestic production to imports than an arrangement that links quota license allocations to purchases of domestic output.

Given the relative rankings of policy instruments, what are the possible interpretations of why the linking arrangement is used in Mali, and what policy recommendations would follow? If the relevant industries were competitive, one possible interpretation is that government's policy objective is to maintain a given degree of import penetration, or ratio between domestic production and imports, and that the linking arrangement is the most efficient policy tool to achieve that objective. In this case the standard recommendation that the quantitative restriction (in this case the linking arrangement) be converted to a tariff would increase the costs of obtaining the objective.

Another, more plausible, interpretation is that the government's objective is to increase domestic production, but the use of the first-best direct subsidy to the industry is not feasible because of the difficulties involved in raising

revenue or the distortions that would be imposed in other markets by the revenue raising activities. Under this interpretation the linking arrangement is the second-best policy to obtain its objective. In this case as well, conversion to a tariff would increase the cost of obtaining the government's goal.

#### D. Linking arrangements and price controls

The discussion in the previous sections assumed that market prices (both the price in the market between domestic producers and distributors and in the market between distributors and consumers) were free to adjust to clear the market. For the products subject to the linking scheme in Mali (sugar and tea) this is not the case because both are also subject to price controls<sup>6</sup>. The existence of the overlapping price control regulations raises a number of issues concerning the net effect of both sets of regulations and the effects of removing one set of regulations but not the other.

To investigate these issues, Figure 4 reproduces the market-determined equilibrium under the linking arrangement from figure 1 and shows the impact of adding price controls. The equilibrium prices and quantities with the linking arrangement are the by-now-familiar  $P_s$ ,  $P_d$ ,  $C_L$  and  $Q_L$ .

Suppose that, in addition to the linking arrangement, price controls impose a ceiling of  $P_d^c$  on the price at which distributors can sell to consumers. Given that this ceiling is below  $P_d$ , the price controls create a disequilibrium in the market between distributors and consumers. At the official price  $P_d^c$  consumers would be willing to buy  $C_L^c$  at the controlled price but domestic producers would only be willing to sell  $Q_L^c$ . Given the domestic purchase requirements to obtain an import license, only  $C_L^c$  would be available in the market. There would be an excess demand of  $(C_L^c - C_L)$ .

The two regulatory measures work at cross purposes. The price controls reduce the divergence between world and domestic selling prices and thus the gain from importing, so distributors have less incentive to purchase from domestic producers. Domestic output would fall to  $Q_L^C$ , and the price paid suppliers would fall to  $P_L^C$ . Price controls dilute the effect of the import license linking arrangement on domestic production, and thus reduce the costs of the linking arrangement.

One interpretation of why the authorities use both price controls and the linking arrangements for tea and sugar is that they are attempting to avoid the consequences of one set of restrictions by imposing yet another. The linking arrangement drives the price to consumers above the free-trade price, so if the policymakers want to stimulate domestic production but also have as a separate objective keeping consumer prices low, they are faced with a dilemma. Using both regulations may reflect an attempt to achieve both objectives, or achieve an administratively determined balance between them.

Any attempt to liberalize and deregulate in the face of overlapping regulatory requirements must face the question of in which order to remove the restrictive measures. In the case discussed here, the removal of price controls while the linking arrangement remained in effect, would increase the price from  $P_L^C$  to  $P_d$ . If the intent is to liberalize the trade regime and reduce, eliminate, or phase out the protection to the domestic industry, this price rise would provide a false signal to the domestic industry as to the direction in which to adjust. Temporarily higher prices may encourage additional investment in an industry that will be reducing capacity as the protection is phased out.

On the other hand, if the linking arrangement were abolished first, the price to the consumer would fall from  $P_L^C$  to  $P_w$ , the price controls would be

redundant, and could be dismantled. Thus if one objective of the government is to keep consumer prices low, a program of liberalization might better achieve this objective if the linking arrangement were abolished before price controls were terminated.

### III. LINKING ARRANGEMENTS WITH MONOPOLY

#### A. A Model of Linking Arrangements with Monopoly

The discussion of linking arrangements so far has assumed that the industry being protected is made up of many small firms which individually have no influence over the market for the product as a whole within the importing country. In the case of sugar in Mali, there is only one domestic sugar refinery. Similarly in other instances where these restrictions have been used, there was only one producer of nylon in Iran and rice marketing in Malaysia is controlled by the government rice marketing board. This type of market structure raises the question of whether the conclusions above about the relative efficiency of the alternative policy instruments carry through if the structure of the domestic market for the affected good is a monopoly.

To answer this question, suppose that there is only one domestic producer or supplier of the import-competing good. Given the incentive system facing distributors under the linking arrangement, the monopoly domestic seller can exploit its market power to maximize profits. If the competitive distributors are maximizing profits, equation (5), above, showed their equilibrium condition, which can be rewritten as:

$$(6) \quad P_s = P_d + r (P_d - P_w)$$

Given that  $P_d$  is a function of the quantity demanded by (1), and  $P_w$  can

be assumed to be given for a small country, (6) can be thought of as the inverse demand function facing the single domestic supplier under the linking arrangements. It shows the amount that distributors are willing to pay the domestic monopolist for various quantities of output, which is the amount for which they can sell the good on the domestic market ( $P_d$ ) plus the value to them of the  $r$  units they can then import under the linking arrangements. In essence the linking arrangements increase the demand curve facing the domestic monopoly supplier.

Figure 5 illustrates the impact of the arrangements on a domestic monopolist. The domestic demand curve for the product is  $D$ . If  $r=1$ , domestic producer output must equal one-half of consumer demand, so the price to the consumer and the domestic producer output must lie along line segment  $ij$ , which bisects the horizontal distance between the demand curve for the product and the vertical axis. The distributor's demand curve for domestic output is given by (6). If  $r=1$ , the price distributors are willing to pay for a given amount of the domestic producer's output can be found graphically by adding vertically (at each output level for the monopolist) the consumer price and the difference between  $P_d$  and  $P_w$  at that output level. The result is shown by the dashed line  $D_R$  in Figure 5.

The domestic monopoly would maximize profits by equating marginal cost and marginal revenue, given this demand curve. The marginal revenue curve associated with the demand curve  $D_R$  is the dashed line  $MR_R$ . If marginal cost were given by the line  $MC$ , the monopoly would produce at  $Q_L$  and sell to distributors at the price  $P_s$ . The price to consumers would be  $P_d$ , and total consumption of imports and domestically produced output would be  $C_L$ .

Given the linking arrangement, distributors buy from the domestic producer

at  $P_d$ , buy in the world market at  $P_w$ , and sell both domestically purchased and imported units to consumers at  $P_d$ . The distributors incur a loss of area  $abcP_d$  on units bought from the domestic producer, but make equal profits of  $cdef$  on imported units, thus breaking even overall. As in the competitive case discussed above, the distributors act as intermediaries to transfer the wedge between domestic and import prices (which can be thought of as tariff-equivalent revenue) to the domestic producer.

#### B. Objectives and Policy Instruments with Monopoly

As in the competitive case, compared with free trade, the linking arrangement increases domestic output, reduces imports, and reduces consumption. In the competitive market structure, the linking arrangement was found to be more efficient than a tariff if the goal is to increase domestic output or to maintain a particular ratio of domestic production to imports. Do these conclusions follow through for the monopoly market structure?

In the analysis so far, the country in which the monopolist produces has been assumed small, which implies that the world price is given at  $P_w$ . A tariff would increase the price of imports by the amount of the tariff revenue per unit, but imports would be freely available at this price. The domestic producer could not charge a price higher than the world market price plus the tariff, so marginal revenue for the domestic firm would equal  $P_w(1+t)$  at all output levels.

If the objective is to increase domestic output to  $Q_L$ , a tariff would have to be high enough so that marginal revenue would equal marginal cost at point  $g$ , or, expressed differently,  $P_w(1+t)=h$  in Figure 5. Domestic price would be lower with the tariff, which implies lower consumer, and therefore social costs of maintaining the chosen production level. This comparison implies that if



domestic production is monopolized, a tariff is a less costly method of promoting domestic production than the linking arrangement, however a direct subsidy to the producer of  $gf$  per unit produced would still be the most efficient of the policies considered.

If the objective is to maintain a particular ratio of domestic production to imports, in this case a 1:1 ratio, then the tariff would have to be large enough to increase marginal revenue to the producer ( $P_w(1+t)$ ) so that marginal revenue would equal marginal cost along line segment  $ij$ . Given the specific cost and demand conditions in Figure 5 a specific tariff of  $nm$  or an advalorem tariff of  $nm/P_w$  would raise the monopolist's marginal revenue under the tariff regime so that it would equal marginal cost at point  $n$ . This maintains the chosen market share for the monopolist, but with higher levels of domestic production and lower consumer prices. Comparing the costs of the linking arrangement and the tariff, there is a tradeoff between the costs of encouraging greater relatively inefficient domestic output, and the gains from lower consumption distortions. The additional deadweight loss from the greater output would equal area  $gnmf$ , while the consumer gain would equal area  $drs$ . In the case shown in Figure 5, the extra production costs outweigh the consumer gains, so the linking arrangement remains less costly than the tariff. However, a lower and flatter marginal cost curve would imply a smaller tariff, resulting in larger consumer gains relative to the extra deadweight losses from relatively inefficient domestic output.<sup>7</sup> This implies that the existence of monopoly also may reverse the rankings of tariffs and linking arrangements as policy instruments when the objective is to achieve a given ratio of imports to domestic production.

Linking arrangements become more costly when the protected industry is monopolized because the linking arrangement increases the degree of monopoly

power that can be exerted by a single seller. The economy suffers losses both from the exploitation of monopoly power and from the distortions inherent in the trade restriction.

The comparison of tariffs and linking arrangements under competitive assumptions above indicated that the linking arrangement used by the government of Mali may be the optimal policy instrument, or at least the second best policy instrument, if the goal of the government is to maintain a given degree of import penetration or stimulate domestic production. Given that the market structure in the protected sugar industry can be considered a monopoly, the linking arrangement is less efficient than a tariff if the government's goal is to promote domestic production and may be less efficient if the government's goal is maintain a domestic market share. Given these conclusions, it would be wise for the government to consider elimination of these restrictions or conversion to tariffs.

#### IV. SUMMARY

As part of its program of trade liberalization, the government of Mali has dismantled the state entity that held import monopolies on a number of products, and has substituted an import licensing system. To obtain a license to import two of these products, sugar and tea, a prospective importer must purchase given amounts of domestic output. The volume of imports is thus "linked" to domestic output of the imported product.

This paper investigated the economic impact of these linking arrangements under two types of domestic market structure, perfect competition and monopoly. Regulations that require importers to purchase from domestic sources before they can import have an effect equivalent to a tariff in which the tariff revenue is

transferred to the domestic industry as a subsidy. These regulations impose costs upon the countries imposing them, but the cost may be more or less than the cost of using tariffs, depending upon the objective of the policy and the structure of the protected industry. If the protected industry is a competitive industry, linking arrangements will be less costly than tariffs if the objective is to increase domestic production or maintain a certain degree of self-sufficiency, defined as a particular ratio of domestic production to imports. These rankings can reverse however, if the protected market is comprised of a single producer.

Overlapping price controls and linking arrangements on the same products dilute the effectiveness of the linking arrangements and result in disequilibrium in the market between distributors and consumers. Removal of the price controls before the linking arrangement in a liberalization would drive up prices to both consumer and the producer, providing false signals and possibly increasing adjustment costs.

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## APPENDIX A

This appendix presents some preliminary calculations of the cost of the regulations on sugar importation and marketing in Mali. In figure 3, the production cost of the linking arrangement was identified as the triangular area blk. This deadweight loss ( $D_p$ ) is equal to:

$$\begin{aligned} D_p &= 1/2 (P_s - P_w) (Q_L - Q_f) \\ &= 1/2 (P_s - P_w) (dQ/dP) P/Q Q/P dP \\ (A1) \quad D_p &= 1/2 (P_s - P_w) E_s Q (dP/P) \end{aligned}$$

where  $E_s$  is the domestic elasticity of supply of the product, and  $dP$  is the change in the price of the product to suppliers if it were to fall to the free trade level.

The consumption cost of the linking arrangement was identified as area irn. This deadweight loss ( $D_c$ ) is equal to:

$$\begin{aligned} D_c &= 1/2 (P_d - P_w) (C_f - C_L) \\ &= 1/2 (P_d - P_w) (dC/dP) P/C C/P dP \\ (A2) \quad D_c &= 1/2 (P_d - P_w) E_d C (dP/P) \end{aligned}$$

where  $E_d$  is the elasticity of demand for the product and  $dP$  is the change in the consumer price if it were to fall to the free trade level.

From information currently available, the landed price of imported granular sugar in Bamako is 119,000 Fcfa per ton. Taxes of 38,681 Fcfa are imposed, so the selling price of imported sugar ( $P_w$ ) would be 157,681 Fcfa per ton if the taxes alone were applied. The official sales price of granular sugar ( $P_d$ ) is 300,000 Fcfa per ton, and the factory gate price of domestically produced sugar ( $P_s$ ) is 254,780 Fcfa per ton. Sugar consumption in Mali ( $C$ ) is estimated to be 39,000 tons per year. Given the linking scheme, domestic production ( $Q$ ) would be one half of consumption, or 19,500 tons.

No estimated elasticities of demand for and supply of sugar in Mali are known to be available, so for illustrative purposes both are assumed to be equal to one.

Given this data and applying equations A1 and A2, the estimated production and consumption costs of the linking scheme and price controls is estimated to be:

$$\begin{aligned} D_p &= .5 (254,780 - 157,681) (1) (19,500) (254,780 - 157,681) / 254,780 \\ &= .5 (97,099) (19,500) (.3811) \\ &= 361 \text{ million Fcfa} \end{aligned}$$

$$\begin{aligned} D_c &= .5 (300,000 - 157,681) (1) (39,000) (300,000 - 157,681) / 300,000 \\ &= .5 (142,319) (39,000) (.4744) \\ &= 1,317 \text{ million Fcfa} \end{aligned}$$

The total deadweight losses, or cost of the linking arrangements and price controls is thus 1,678 million Fcfa per year, or 5.75 million US dollars per year at 1988 exchange rates.

These numbers must be taken as very rough estimates that illustrate the potential magnitude of the efficiency losses involved in the overlapping regulatory controls on sugar marketing. In the first place, they are based on a guess of the demand and supply elasticities. They also ignore distribution costs, which would increase the free trade price to the consumer and reduce the estimated costs.

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ENDNOTES

1. See Republique du Mali, "Proposition..." for an explanation of the program.
2. See Republique du Mali. "Note..." for an explanation of the procedures.
3. See Jenkins and Kwok-Kong (1988), for a description of Malaysian rice policies and an analysis of the mixing regulation along the same lines as the approach taken here.
4. Corden (1973) presents an analysis of mixing regulations similar to that used here. Similar license allocation methods have been analyzed by McCulloch and Johnson (1973) and Bark and de Melo (1988). The model used here also appears in Takacs (1989) and Takacs (forthcoming).
5. 
$$\text{Area deji} = (P_t - P_w)(C_R - C_T) - 1/2(P_t - P_d)(C_R - C_T)$$
$$\text{Area ahgc} = (P_t - P_w)(Q_R - Q_T) + 1/2(P_s - P_t)(Q_R - Q_T)$$

Let  $(C_R - C_T) = c'$ ;  $(Q_R - Q_T) = q'$

The extra cost of the tariff (X) is thus:

$$X = (P_t - P_w)c' - 1/2(P_t - P_d)c' - (P_t - P_w)q' - 1/2(P_s - P_t)q'$$

Because  $c' = 2q'$  and  $(P_t - P_w) = (P_d - P_w) + (P_t - P_d)$ ,

$$X = (P_d - P_w) q' - 1/2 (P_s - P_t) q',$$

which must be positive because  $(P_d - P_w) = (P_s - P_d)$ , and  $(P_s - P_t)$  must be less than  $(P_s - P_d)$ .
6. See Stryker, Dethier, Peprah and Brean (1987) for a description of the price control system.
7. The reader can verify the reversal in the rankings of the instruments in Figure 5 by working through the case with a flat marginal cost curve that crosses  $MR_k$  halfway between points g and k.

Figure 1

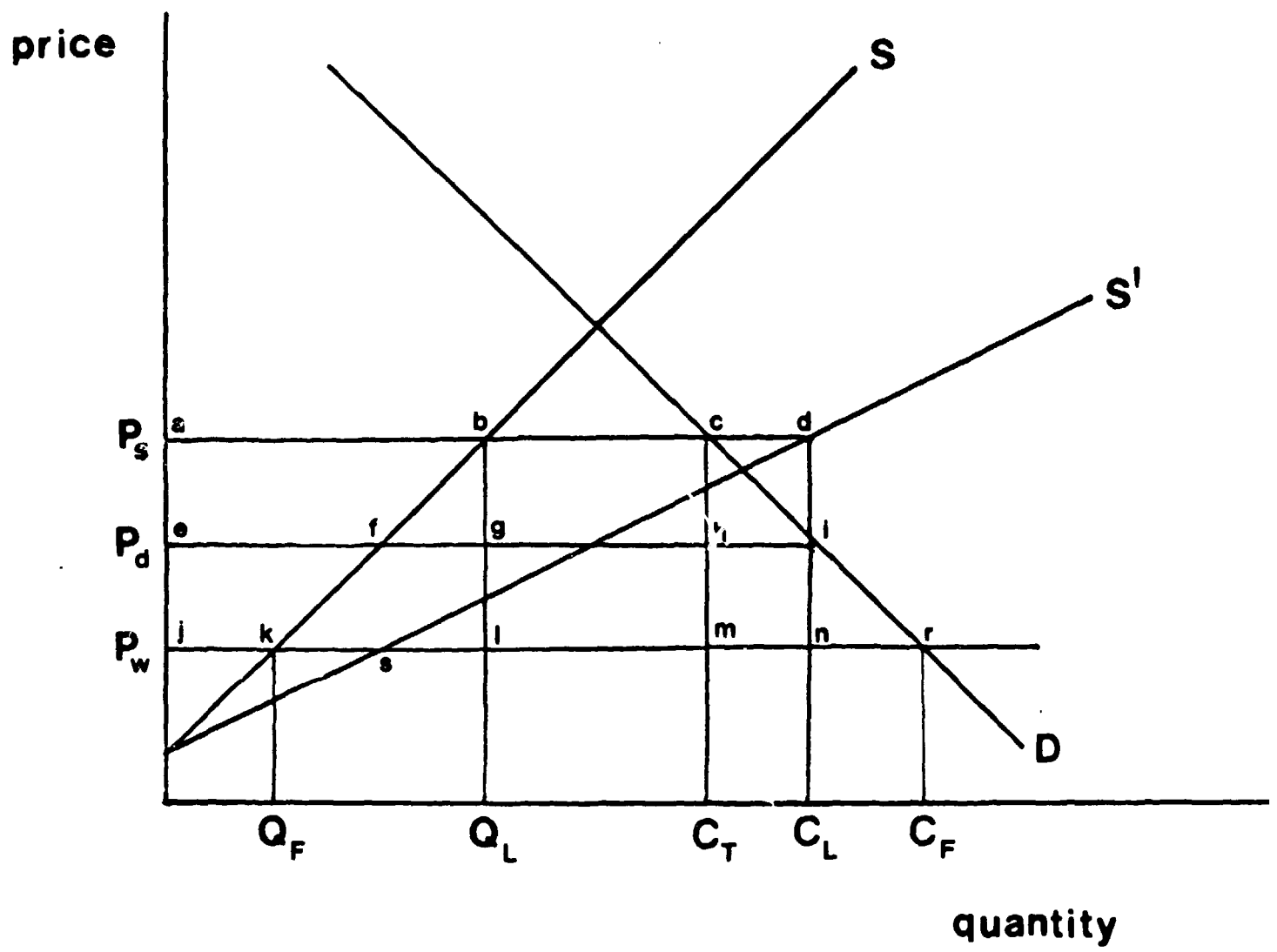




Figure 2

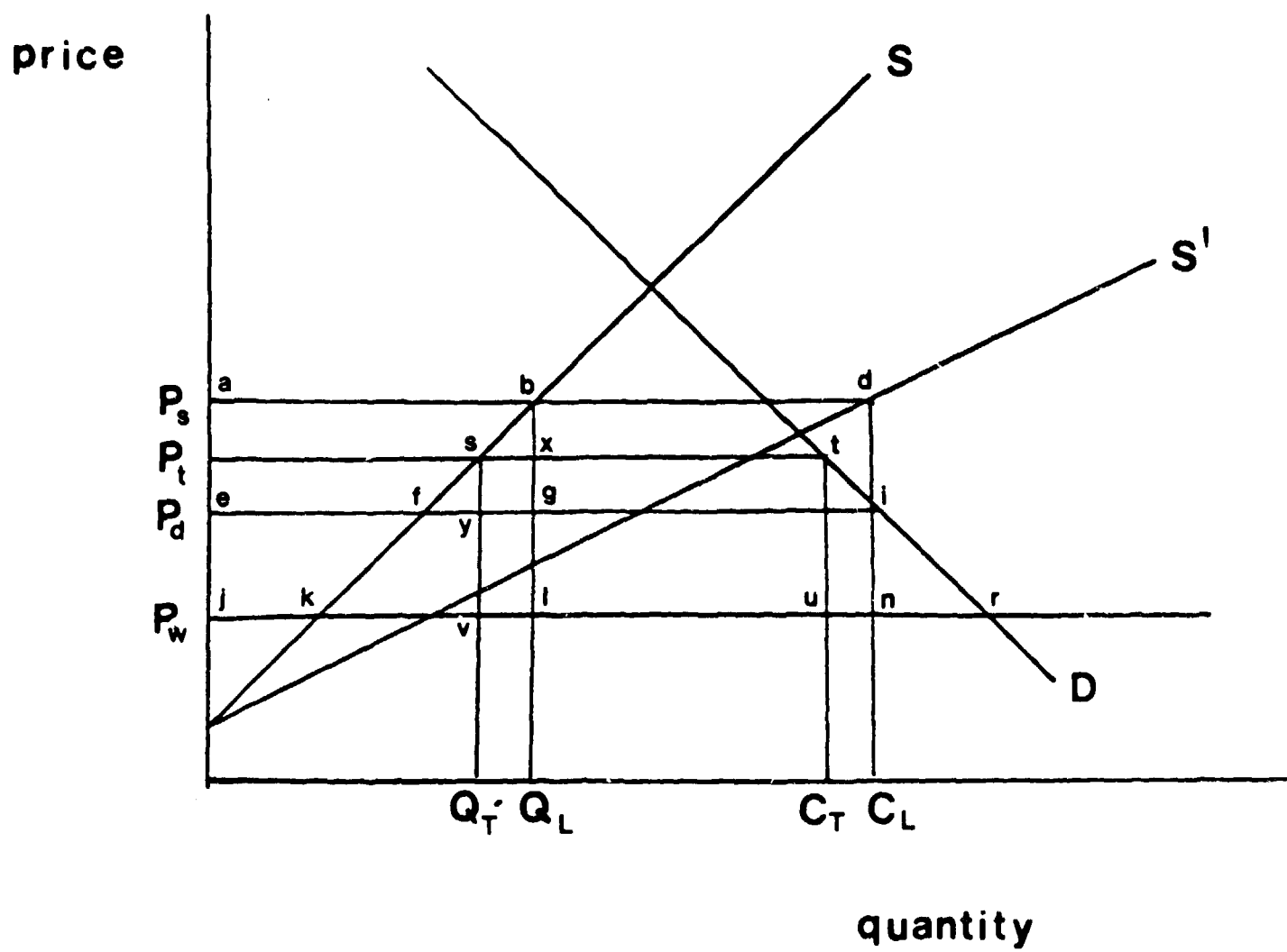


Figure 3

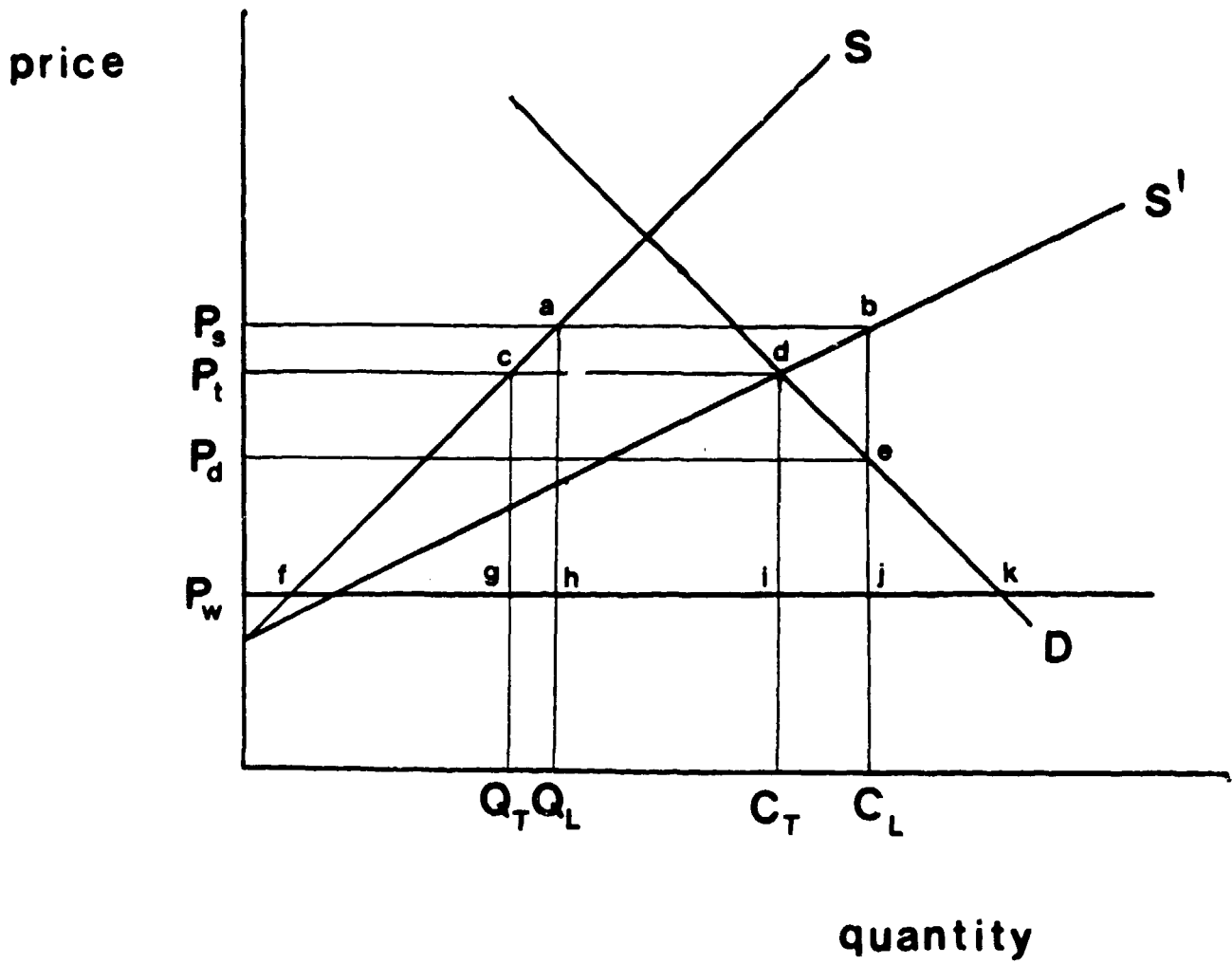


Figure 4

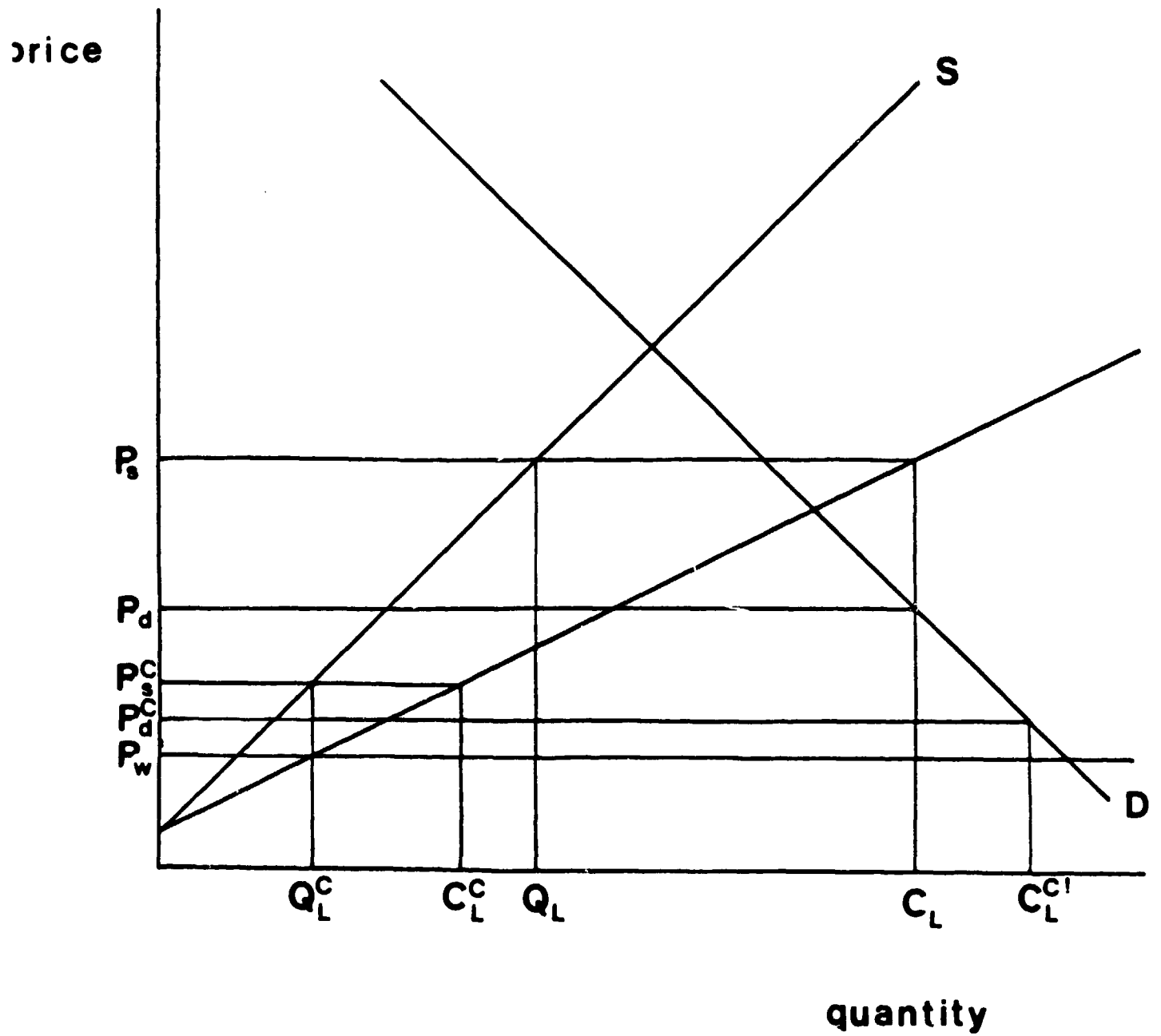
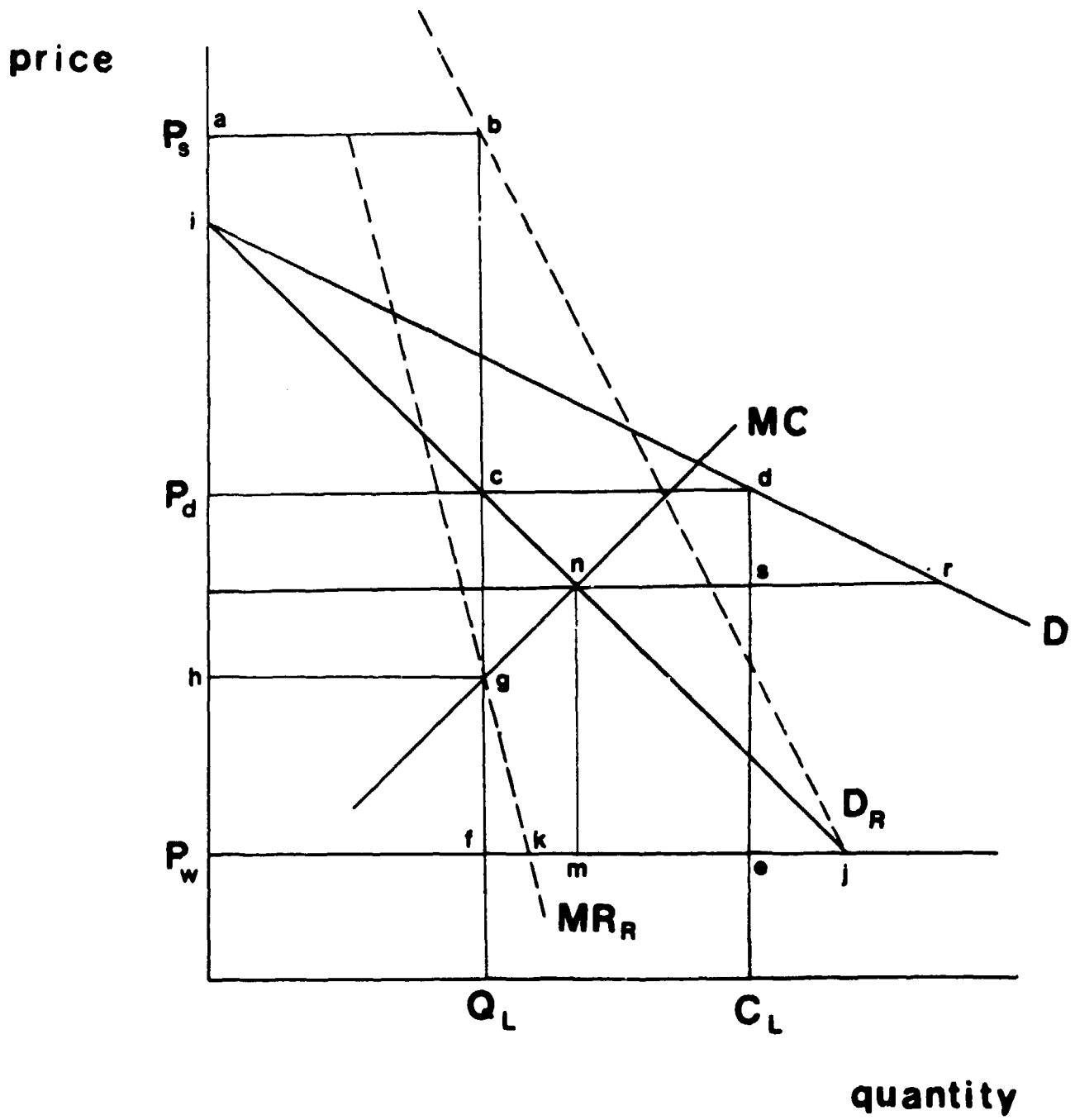


Figure 5



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